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An ICT based training system: A case study for agricultural insurance brokers in Iran

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ABSTRACT

Many organizations have adopted ICTs as a solution for their corporate training. The Agricultural Insurance fund (AIF) also has considered the necessity of using ICTs for training brokers that are working throughout the country and have direct interaction with policy holders. As a result, designing an ICT based training system is crucial for creating the new opportunities for brokers to update their information. Statistical population of the study consisted of 4903 private agricultural insurance brokers in Iran. Based on the classification of the AIF which has divided these centers into six regions and using the stratified sampling technique and the results from the pilot test, 235 brokers were surveyed. The initial and follow-up mailing generated 216 useable responses from brokers resulting in a response rate of 91%. In this research, it has been found some factors that should be considered before implementation of the system. Namely, (1) ordinal logistic regression indicated that the factors which affect on designing an ICT-based training system are technical, financial, instructors, and learner factors; (2) The ordinal factor analysis classified the challenges into four latent variables named organizational, social, human, and technical challenges. (3) The ordinal coefficient of variation pointed out the most important challenge of the ICT-based training methods which are bandwidth, low quality, updating and screen size respectively for synchronous, asynchronous, CD and mobile learning. Finally a conceptual framework is presented for the ICT training system.

Keywords: *information and communication technology (ICT); system; training; brokers; agricultural insurance;* synchronous; asynchronous; Compact Disks; mobile learning.

1. INTRODUCTION

The Iranian crop insurance scheme began in 1984 with cotton, in the northern province of Mazandaran, and sugerbeet, in the north western province of Khorasan. Gradually the insurance activity for these two products, along with other products, was extended throughout the country. Now, the range of products which agricultural insurance fund covers reached to 80 main products in agriculture, horticulture, livestock, forestry and pastures, more detail can be found in Rahmani (2009). However the number of insurance brokers was insufficient to implement the insurance scheme, so, in 2002, the AIF decided to hire private sectors named “brokers”, to keep pace with the increasing demand for coverage and improve the quality of services. According to the latest reports in 2008, more than 90% of insurance contracts sales and 70% of loss assessments have been completed by private sector brokers. The reports also indicate that the loss ratio is 2.6, which is considerably high compared with the international level, and is most likely a result of unrealistic assessments carried out by brokers (AIF, 2008).

In these challenging and rapidly changing times, organizations are becoming more convinced that the only lasting differentiator and source of competitive advantage is their human capital. According to Hall (2000), executives increasingly realize that the fate of their companies rests on their employees' ability to absorb information rapidly and learn the necessary skills.

One of the main strategies to improve the quality of services is to train brokers. AIF uses the traditional face-to-face methods to train brokers, but this often fails to work for several reasons, namely: (i) the number of brokers is considerably high (5000 persons); (ii) the brokers are scattered throughout the country in 32 provinces; (iii) this method of training is very costly, difficult to manage, and implement for the AIF.

Lippert and Plank (1999) emphasize on Appling ICTs in these cases. They noted that it is an effective, very flexible delivery method and it brings the added benefit of being able to have experts and specialists from different regions in the same class without transportation and lodging costs (Lippert and Plank, 1999). Several studies, including one by Lippert and Plank (1999) ultimately proved, with strong support of all of the participating learners, that "the Internet can be an effective way to implement an in-service training within the US Cooperative Extension Service" (Lippert and Plank, 1999). In the other hand, according to Karmakar and Wahid (2009) developing and expanding e-learning brings many opportunities for organizations including (1) saving time, money and effort; (2) addressing training needs from remote areas; (3) providing self-learning opportunities; (4) having a positive impact on the learning process; (5) providing a mechanism for collaborative learning (Karmakar, 2000). Also through the e-learning systems, workers have access to various on-line databases, tools and the most advanced skills that help them find solutions for work-related problems (Zhang and Nunamaker, 2003).

The purpose of this study is to design an ICT-based training system to train the brokers in Iran. The objectives of this study are as follows: 1) develop a theoretical and conceptual framework; 2) identify appropriate ICT media; 3) identify factors which affect the efficiency of the system; and 4) identify challenges of the system. 5) And identify challenges of all types of ICT-based training methods.

This paper is organized as follows. Section 2 begins with some definitions and then a discussion of affective factors and challenges with which an ICT-based training system will be faced in practice. The related literature for both affective factors and challenges follows. Sections 3 and 4 provide a theoretical framework, study hypotheses, target population, and sampling method. Data are analyzed in section 5 by employing sophisticated statistical techniques, such as ordinal logistic regression and ordinal factor analysis; which are available in statistical software Minitab 14 and Lisrel 8.8 (student version).

2. PRIOR STUDIES

This literature review has been covered some existing literature reviews on (1) affective factors and (2) challenging in designing an ICT-based training system.

Affective Factors in designing an ICT-based training system

Many studies have identified important variables dealing with an ICT-based training system. Table 1 summarizes some of their results. One can summarize results given in table 1 into cultural, financial, evaluation, learner, instructor, expert, and organizational factors. Those eight factors are introduced and discussed in Section 3.

Table 1: *Related references about the factors affecting an ICT-based training system*

Author	Factors
Barajas&Owen 2006)	Infrastructure, hardware, software, skills, and cultural organizational.
khan (2001)	Evaluation, interface design, technological, pedagogical, institutional, ethical, resource support, and management.
Dirr (2001)	Physical & intellectual infrastructure, data, and telemetric services.
Surry (2002)	Resources, infrastructure, human, strategies, learning, evaluation, and support.
Rusten&Ramirez (2003)	Connectivity and access, capacity building, content and application development, conducive governance, and policy.
Ouyang(2004)	Online instructional tool and design.
Ebadi (2005)	Software, hardware, communicative hardware, human resources, data, and sources.
Angela Lo (2005)	Technical, legal and cultural infrastructures.
Mesda (2005)	Hardware, software, human ware, and network.
Tai (2005)	Strategic vision, well defined learning organization, strong leadership, corporate support, content and accountability of learners, and instructors
Sribhadung (2006)	Strategically planning, curriculum, and content, use of the internet and acceptable use policies, connectivity infrastructure and network, intellectual property and copy right, intergovernmental issues and cost , finance, and partnership.
Sun et al. (2007)	Learner, instructor, course, technology, design, and environmental dimension.
MacDonald et al. (2001)	Superior structure(learner needs, learning environment, pedagogical, learner evaluation, learner motivation, program goal, strategies, learner convenience), superior content (comprehensive, authentic, industry driven research), superior delivery (usability, interactivity, tools, instructional strategies), superior service(resources, administrative and technical support, staff, accessibility, responsiveness), superior outcomes(lower cost for learner and employer, personal advantages for learner, superior learner outcomes), continual adaptation and improvement, ongoing program evaluation.

The challenges in applying an ICT-based training system

Simply defined, challenge is a new or difficult task that tests the ability, capacity, and skills of a person, organization or community (Oxford, 2002). In a challenging environment, one may find threats and change them into opportunities, which is the desired outcome of a dynamic system. On the other hand, if people who are involved in a system are not familiar with of its potential challenges, these challenges will be transformed into threats; with additional information, however, they can be transformed into opportunities (Zamani et al, 2006). Therefore, along with designing a system, we might identify challenges and provide some practical ways to transform them into opportunities. We consider the problems of implementation of the system as challenges not as threats which indicate the attitudes of the authors. The authors' point of view emphasize that each problem has two negative and positive dimensions, and one can transform a negative dimension to a positive one by cognition and understanding of the nature of a problem. Table 2 reviews opinions of some authors about challenges of the system.

Table 2: *Related researches about the challenges in applying an ICT -based training system*

Authors	Challenges
Murphy&Terry (1998)	Cultural conflicts and high costs
Ho (2002)	Incompatibility of information infrastructure, incompatibility of learning style, complexity of e-learning course production, and lack of intellectual property protection.
Bersin,Holder&King(2003)	Content development, Infrastructure and deployment
Crase (2004)	Inaccurate definition of special skills
Cantoni *et al* (2004)	Lacking informal social interaction and face-to-face contact of traditional learning
Leary & Berge (2005) Sim & Fersht (2007)	Hands-on component which needs face-to-face training Lack of IT infrastructure, lack of governmental and cultural support, corporate attitude that does not value training

The challenges in applying each ICT based training methods

ICTs include technologies and methods to store, manage, and process information, such as computers, soft wares, and for communicating information, such as email and the web, (Rusten & Ramirez, 2003). In this research, ICT based training can be categorized into four types as follows:

(1) Synchronous training methods, which require simultaneous participation of all learners and instructors at distributed locations and include immediate, two-way communication between participants. This may take the form of video conferencing and virtual classrooms. (2) Asynchronous instruction methods, which do not require simultaneous participation of learners and instructors. It gives learners more freedom over learning time, process and content of curriculum (Anaraki, 2004). (3) CD and DVD learning techniques, which include training via compact and digital video discs. Knowledge stored on the web can be updated, but this is not possible with other formats, such as CDs and DVDs. (4) Mobile instruction methods, which include all mobile devices, such as cell-phones and laptops. This takes advantage of learning opportunities offered by portable technologies (Sribhadung, 2006). Table 3 considers the challenges for each ICT based training methods.

Table 3: *Challenges of ICT-based training methods*

ICT-based training methods	Sources	Challenges
Synchronous	Gold, 2004; Akir, 2006	High bandwidth for video conference, simultaneous connection of all users, special access such as microphone and webcam, low quality of voice and image.
Asynchronous	Al banna, 2006; Akir, 2006; Nath Rai, 2000	Low quality of multimedia, communication without immediate feedback, limit capacity of free web services, loosing concentration because of ads.
CD	Krus & Keil, 2000; Brough, 2006.	Updating, professional software, one way communication, Distribution, high cost
Mobile instruction	Sribhadung, 2006; Basol, 2006.	Battery charge, small screen size, limited connection to web, small keyboard of cello phones.

3. RESEARCH VARIABLES

The research in terms of nature is a kind of quantitative research and in terms of goal is applied research, in terms of controlling the variables is descriptive and correlation kind, which has been carried out in a survey way.

An efficient training system identified by its *Affordability*, *Availability*, and *Adaptability,* also known as triple As. (Aluko, 2004 & Dunmade, 2002). This research measures those variables for each broker training method. Finally, all twelve variables summarize into a single variable which is the dependent variable, called *efficiency of an ICT-based training system from respondents' viewpoint*. Thirty-six independent variables can be categorized into eight factors which are presented alongside with their related hypothesis in Table 4.

Table 4: *Independent variables and research hypothesis*

Factor	Variables	Reference	Hypothesis
Technical	Synchronous softwares; Asynchronous softwares; Hardware; Presentation framework, e.g. internet and intranet; Telecommunication facilities, e.g. Bandwidth, telephone line.	Castels (1996)	There is a significant relationship between an efficient ICT-based training system and technical factors.
Cultural	Beliefs about virtual education; Positive attitude toward life long learning; positive attitude towards the use of modern technology	Sullivan (2002)	There is a significant relationship between an efficient ICT-based training system and cultural factors.
Financial	Financial sources for buying equipment; Budget for the recruitment of experts; Expense of maintenance; Support and up-to-date training; Expense of upgrading and changing pieces; Expense of advertisement and cauterization; Expense of preparing digital content	Self development	There is a significant relationship between an efficient ICT-based training system and financial factors.
Evaluation	Educational achievement; Learners' attitude; Standards courses development and presentation; Quality and quantity of timely and constructive feedback to learners	Barajas & Owen (2006)	There is a significant relationship between an efficient ICT-based training system and evaluation factors.
Learner	Knowledge and skills about ICT; Positive attitude towards using ICT in education; Information about legal affairs; Self directedness	Guglielmino (2002)	There is a significant relationship between an efficient ICT-based training system and learner factors.

Instructor	Knowledge and skills using ICT; Positive attitude towards the use of ICT; Information about legal affairs Facilitating	Lynch (2002)	There is a significant relationship between an efficient ICT-based training system and instructor factors.
Technical expert	Full-time support to solve problems; Familiar with agricultural insurance affairs; Specialized in ICT- based training; Specialized in learning management software (LMS).	Self development	There is a significant relationship between an efficient ICT-based training system and technical expert factors.
Organizational strategies	Providing human resources; Issue and evaluating certificates; Legislation of intellectual properties of Experts.	Tai (2005)	There is a significant relationship between an efficient ICT-based training system and organizational strategies factors.

Using previous studies (given in Table 2) and interviews with some experts in the field of e-learning in the agricultural sector, the following variables as challenges were considered in this study: Low bandwidth (Kerka, 1998); technological phobia (Samak, 2006); lack of appropriate software (Samak, 2006); certification credit (Tyan, 2003); need time and energy to present virtual education(Tyan, 2003); lack of appropriate hardware (Samak,2006); security affaire(Mungania, 2004); cost of updating contents(Tyan, 2003); organizational staff not taking virtual education seriously (Tyan, 2003); negative attitude of organizations; need interaction with experts (Cantoni et al 2004); waste time by surfing the internet(Cantoni et al 2004); lack of social interaction and face to face contact (Mungania 2004 & Anaraki,2004); limited access to the internet in the workplace(Cantoni et al 2004); intellectual property rule (Tyan,2003); lack of non verbal feedback (Ouyang, 2004); require more self discipline(Cantoni et al 2004); lack of appropriate ICT infrastructure(Cantoni et al 2004); limited access to the internet at home (Cantoni et al 2004); high cost for ADSL method(Cantoni et al 2004); requires new knowledge and skills (Cantoni et al 2004); inadequate experts in virtual education; lack of appropriate support services; Difficulty in determining job skills (Crase,2004); lack of motivational constructs for using virtual education(Leary & Berge,2005); lack of relationship between instructors and students(Leary & Berge,2005); prejudiced beliefs of learners towards traditional education (Tyan ,2003); the limitation of virtual training for practical techniques (Leary & Berge,2005); misunderstanding of the advantages and disadvantages of virtual education(Tyan ,2003); Incompatibility of online training with values and culture (Leary & Berge,2005); negative experiences of users (Tyan, 2003)

4. RESEARCH DESIGN

A series of in-depth interviews were conducted with senior experts in AIF as well as experts in e-learning to examine the validity of the research model. After that, the questionnaire items was developed based on those interviews and previous literature. The questionnaires were revised with the help of experts with significant experience in e-learning (including academic and AIF). A 5–point likert scale ranging from 1 as strongly disagrees to 5 as strongly agree was used for the measurement. A pretest for the reliability and validity of the instrument was conducted with 30 brokers randomly chosen from the target population. The factors and challenges were summarized into two single variables F and C. Then, the Cronbach's alpha from those variables as well as for the efficiency variable, labeled E, given in Section 3 was computed. The Computed

Cronbach's alphas for F, C, and E are 96.8%, 94.9%, and 90.8%, respectively, which indicated the high reliability of our questionnaire.

The research population included all the private agricultural insurance brokers in Iran (with population size N=4903). Using the stratified sampling technique and the results from the pilot test and based on the classification of the AIF (which has divided these centers into six regions) 235 brokers were surveyed. Questionnaires were distributed by mail across the country. The initial and follow-up mailing generated 216 useable responses from brokers resulting in a response rate of 91%. This response rate accompanies suggestions written at the end of many questionnaires, which indicated that the respondents found the topic interesting and relevant (Table 5).

Table 5: T*arget and sample population*

Province	Total number of brokers	Sample
Esfahan	130	24
Kerman	247	44
Elam	67	12
Khorasan Razavi	341	62
Hamedan	119	21
Gilan	401	72

This research used three statistical packages, Minitab 14, SPSS 16, and Lisrel 8.8 to analyze the data. Data was analyzed using the following three techniques.

Ordinal C.V

It is well-known that it is not possible to use the C.V. as a criterion to compare variables whenever those variables are ordinal. (More can be found in Agresti, 1996, 2002, and Johnson & Albert 1999). Now, one can develop a new C.V, called ordinal-CV, which may be used for ordinal variables. The nature of the data prevents us from employing the mean as a centrality criterion. In this case an alternative for the mean would be the median (Agresti 1996, 2002, and Johnson & Albert 1999). A common criterion to measure dispersion data from the mean is standard deviation, but it cannot be used the mean with an ordinal variable, called Ordinal-S.D. An ordinal-S.D. is defines as $S.D_{Ord} = \sqrt{\sum_{i=1}^{n} (x_i - m)^2}$ which measure the dispersion of data from the median, m. Consequently, an alternative C.V. (named ordinal-C.V) for ordinal data is given by $C.V_{Ord} = \frac{S.D_{Ord}}{m}$.

Ordinal Logistic Regression

The binary logistic regression is a well-known technique to set up a generalized linear model for the binary dependent variable. But for multiple ordinal dependent variables, the binary logistic regression does not work properly. Statisticians developed an ordinal logistic regression to handle multiple ordinal dependent variables. Minitab 14 is a statistical software package that can fit an ordinal logistic regression to data. The output of the software includes: 1) *Response and Factor Information*, which displays the number of observations and the response and factor categories; 2) *Logistic Regression Table,* which shows the estimated coefficients, p-values (related to a test

that the corresponding coefficient is zero), and odds ratio (which shows the effect of variables on the model); 3) *Goodness-of-Fit Tests,* which display both Pearson goodness-of-fit test of the model to data. The steps in model building for an ordinal logistic model are the same as those for the binary logistic regression model. Unfortunately, the full array of modeling tools is not available in the software packages. So, one has to choose a final and appropriate model by entering variables with significant coefficients (p-value<0.05) and ordering effect of variables from their Odds ratio (negative coefficient along smallest odds ratio indicates more impact of the variable on the dependent variable, McCullagh & Nelder, 1992). Finally, appropriative of model is evaluated by (i) a G test whose its null hypothesis states all the coefficients associated with predictors equal zero versus at least one coefficient is not zero (we prefer to reject their null hypothesis, i.e., p-value <0.05) and (ii) Goodness-of-Fit Tests, (we prefer to accept their null hypothesis, i.e., p-value >0.05), more can be found in Hosmer & Lemeshow (2000) and McCullagh & Nelder (1992).

Ordinal Factor Analysis

The basic idea of factor analysis is the following:For given set of observed variables $Y_{1,\ldots,}$ Yn , one wants to find a set of latent variables $\xi_1, \ldots \xi_k$, k<n that contain essentially the same information. The classic factor analysis assumes that both the observed and the latent variables are continuous variables. But, in practice, the observed variables are often ordinal. However ordinality is most often ignored and numbers such as “1, 2, 3, 4”, representing order categories, are treated as numbers having metric properties (treated the same way as continuous variable); such a procedure is assuredly incorrect in several ways. Several authors have considered factor analysis for ordinal observed variables. Joreskog & Moustaki (2001, 2006) used the EM-algorithm technique to make factor analysis for such observed variables. The last version of their statistical software package, named LISREL 8.8 can handle such analysis. As far as we know, the software cannot directly evaluate the goodness of model. This means that the Goodness of the model must be measured by fitting an equation model (SEM) to the data and then using statistics that are available in the SEM. Briefly, we used: 1) Goodness of fitness whose null hypothesis indicates that the model is valid (we prefer to accept the null hypothesis, i.e., p-value>0.05); 2) RMSEA (Root Mean Square Error of Approximation), which takes into account the error of approximation in the population and asks the question “How well would the model fit the population covariance matrix if it were available?” (p-value less than 0.05 indicates good fit, and higher than 0.08 represents reasonable errors of approximation in the population), Joreskog & Moustaki (2001, 2006).

5. RESULTS

Table 6 summarizes the demographic profile and descriptive statistics, while Table 7 represents ordinal-C.V. of the triple "A" for each category.

Table 6: *Demographic profile and descriptive statistics of brokers*

Sex	Female (37.5%)	Male (62.5%)
Age/year	Mean=30.95	S.D=5.56
Work experience/year	Mean=5.30	S.D=4.81
Computer usage (weekly)/hour	Mean=13.24	S.D=14.14
Internet usage (weekly)/hour	Mean=4.99	S.D=6.39
Degree	Undergraduate=84.1%	Graduate=15.9%

Table 7 *Ordinal coefficient of variation*

	Adaptable	Available	Affordable	Total	Rank order
Asynchronous	0.3349	0.3763	0.3402	0.3302	3
Synchronous	0.3529	0.4937	0.4357	0.4273	4
CDs	**0.2170**	**0.2381**	**0.2435**	**0.2145**	1
Mobile	0.2673	0.2978	0.2514	0.2501	2

As one may observe, CDs is the most efficient method with a total of three criteria met.

Ordinal Logistic Regression

Since all variables in this research are ordinal, one has to employ the median to summarize a group of variables into one single factor. Firstly, variables in Part 2 (efficiency variables) are summarized into a dependent variable. Meanwhile, independent variables are obtained by summarizing variables into factors; both of which are given in Table 4.

Table 8 presents the coefficient, p-value and odds ratio of our ordinal logistic regression analysis.

Table 8: *Ordinal logistic regression*

	Dependent variable, i.e., efficiency of the model.			
	Coefficient	P-value	Odds ratio	Rank order
α_1	0.756	0.523	___	___
α_2	1.805	0.084	___	___
α_3	3.788	0.000	___	___
α_4	4.651	0.000	___	___
α_5	6.212	0.000	___	___
α_6	6.874	0.000	___	___
α_7	9.113	0.000	___	___
α_8	9.951	0.000	___	___
Technical(Tech.)	-0.967	**0.000**	0.38	1
Cultural (Cult.)	-0.238	0.246	1.27	
Financial (Fin.)	-0.580	**0.011**	0.56	2
Evaluation (Eva.)	-0.076	0.735	0.93	
Learner (Lea.)	-0.098	**0.003**	0.91	4
Instructor (Inst.)	-0.185	**0.040**	0.83	3
Technical expert (Tech. Ex)	-0.087	0.732	1.09	
Organizational strategies (Org. St.)	-0.052	0.825	0.95	
P-Value for test that all coefficients are zero= 0.0				
P-Value of the Goodness-of-Fit Tests= 0.927				

One can summarize the results of Table 8 as follows:

- The P-Value indicates that for 0.05 alpha-level, there is sufficient evidence to conclude that Technical, Financial, Learner, and Instructor factors are significant ones.

- Small odds ratio indicates that impact of factors can be ordered as Technical, Financial, Instructor, and, Learner factors.
- P-Value=0.00 for test that "all coefficients are zero" along with the P-Value for"the Goodness-of-Fit Tests" >>0.05 (0.927) indicate that the ordinal logistic regression is an appropriate model to analyze the data.
- The ordinal logistic regression gives 8 parallel equations ($i = 1,2,\ldots,8$) which are

$$\gamma_i = \frac{\exp\{\alpha_i - 0.9670Tech. - 0.5801Fin. - 0.0980Lea. - 0.1852Inst.\}}{1+\exp\{\alpha_i - 0.9670Tech. - 0.5801Fin. - 0.0980Lea. - 0.1852Inst.\}},$$

Where γ_i is the cumulative probability efficiency of the ICT of i^{th} level and $\alpha_1, \alpha_2, \ldots, \alpha_6$ are given in the above table.

Ordinal Factor Analysis

Implementation of "ordinal factor analysis" along the structural equation model (SEM), the challenges, introduced in prior studies, can be classified into 4 latent variables.

Table 9: *Ordinal factor analysis about challenges*

Factor Name	**Variables included**	**Explained common variance by factor**
Technical challenge	Low bandwidth; Lack of appropriate hardware and software; technical challenge; Lack of appropriate ICT infrastructure; Limited access to internet at work and home; The limitation of virtual training for operational techniques.	17.78%
Human challenge	Require new knowledge and skills; Prejudiced beliefs of learners; lack of understanding of advantages and disadvantages of virtual education; Negative experiences of users; Need interaction with experts; Waste time by surfing the internet; Require more discipline; Not adequate experts; technological phobia.	13.12%
Social challenge	Lack of social interaction and Face to face contact; Intellectual property rule; Certification credit; Lack of relationship between instructors and students; online training incompatible with values and culture; lack of non verbal feedback; Security affairs; Lack of motivational construct.	10.79%
Organizat-ional challenge	Cost of updating contents; Certification credit; Needing time and energy to present virtual education; organizational staff not taking virtual education seriously; High cost for ADSL method ; Lack of appropriate supportive services; Negative attitude of organizations towards virtual education; Not appropriate advertisement about the capabilities of virtual education; Difficulty in determining skills of jobs; cost of virtual education.	12.16%
Total	————	53.85 %

One can observe from Table 10; the goodness of test value, along with a small value of root mean square error of approximation (RMSEA) for both brokers and experts verifies fitness of model to data.

Table 10: *Goodness of fit test and RMSEA of the model*

Test	Statistic of test (p-value)
Goodness of fit test (p-value)	596.0196 (0.19)
RMSEA (p-value)	0.190 (0.021)

Table 11: *Ordinal C.V.* of challenges of ICT-based training methods

ICT-based training methods	challenges	Ordinal C.V.	Rank Order
Synchronous	High bandwidth for video conference	0.2101	1
	simultaneous connection of instructors	0.2243	2
	simultaneous connection of learners	0.2300	3
	special access such as microphone and webcam	0.2574	4
	low quality of voice and image	0.2786	5
Asynchronous	Low quality of multimedia	0.2338	1
	communication without immediate feedback	0.2482	2
	limit capacity of free web services	0.3207	3
	loosing concentration because of ads	0.3224	4
CD	Updating	0.2517	1
	Distribution	0.2923	2
	one way communication	0.3078	3
	high cost	0.3175	4
	professional software	0.3379	5
Mobile instruction	small screen size	0.2362	1
	limited connection to web	0.2562	2
	small keyboard of cello phones	0.2728	3
	Battery charge	0.3623	4

As one may observe (Table 11), the ordinal coefficient of variation pointed out the most important challenge of the ICT-based training methods which are high bandwidth for video conference, low quality of multimedia, updating and small screen size respectively for synchronous, asynchronous, CD and mobile learning.

6. DISCUSSION

The following discussion addresses the research findings according to the research objectives.

Develop a theoretical and conceptual framework

According to the results, the conceptual framework can be illustrated as shown in Figure 1.

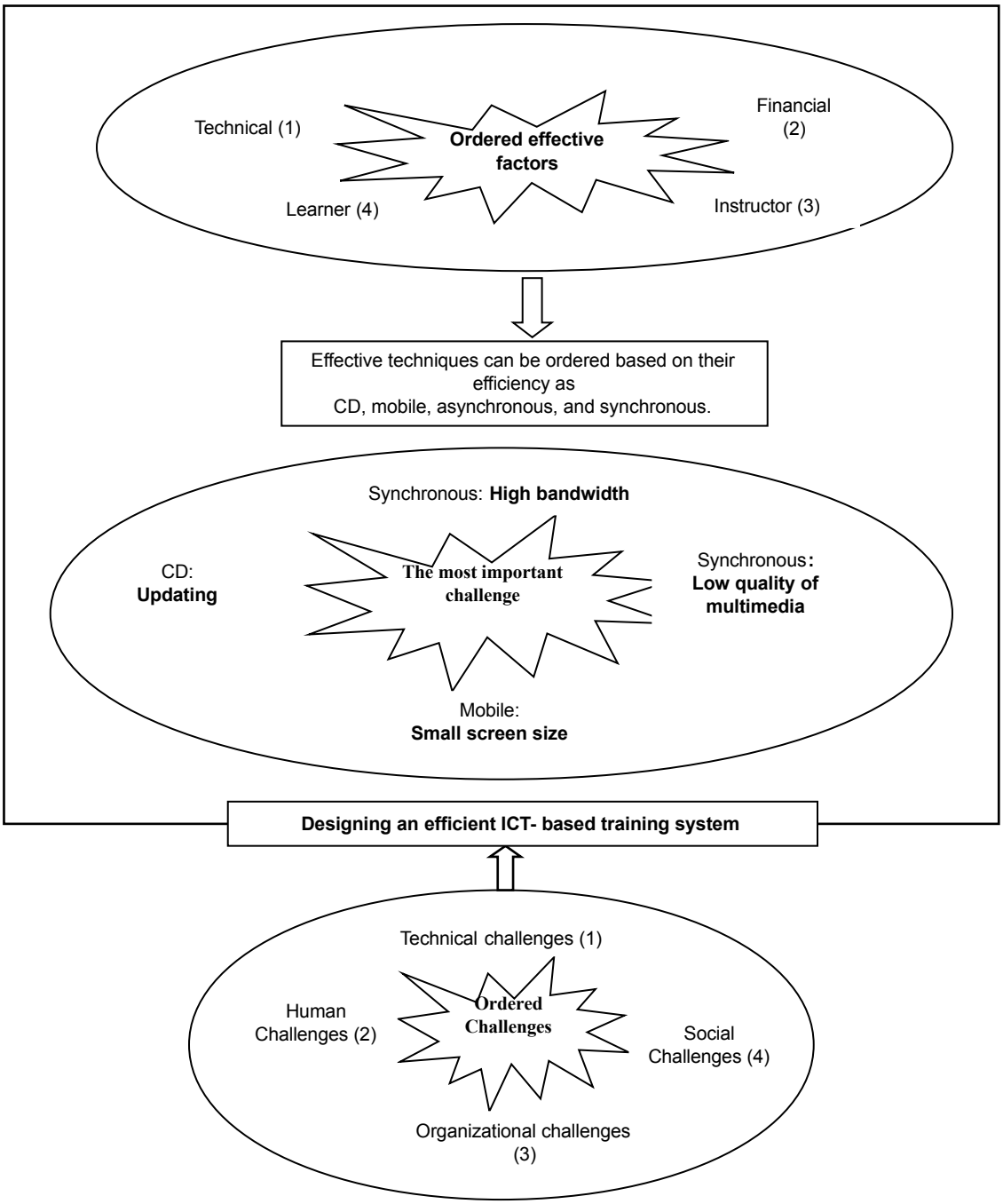

Figure 1: *A conceptual framework to design an ICT-based training system*

Identify appropriate ICT media to train brokers

The methods to train brokers in order of efficiency are CDs, Mobile, asynchronous, and synchronous. The findings indicate that the CD is the most efficient media to use to train brokers, an observation which is also verified by several authors, such as Kruse & Keil (2000). Also, Sielaff et al (2005) indicated that training via CD is more effective than other methods, because the interactive CD allows trainees to make their own choices, see the consequences of these choices based on evaluation of their performance, and repeat the process all at their own pace. This conclusion, along with the fact that "assessment of the loss ratio" is one of the most important elements of broker training, leads us to recommend AIF to prepare a multimedia package, stored on a CD, which stimulates different damaged farms and improves the ability of brokers to estimate the true loss ratio.

Mobile phone use is the second most important media source to train brokers. The most unique and distinguishing characteristic of the mobile phone method is its ability to provide services to the user anytime, anywhere, during his physically movement (Basole, 2006). Traditional wired telephones limit users to the location of the device and network plug-in. The fact that a broker has to own a cell-phone according to AIF rules explains why the mobile training method is the second selected method by the brokers. We suggest that the AIF use the SMS (short massage service) to immediately distribute important information to brokers, especially during a crisis.

The asynchronous method is named as the third most effective method to train brokers. Asynchronous methods, as compared to synchronous methods, require low bandwidth. Most brokers have access to low- speed internet (over 50% of brokers use a dial up internet connection). On the other hand, using the asynchronous method, students do not need to schedule their time around the predetermined plan of the instructor, (Kruse & Keil, 2000). Based on these observations, we suggest that the AIF use the asynchronous method to distribute urgent, up-to-date information in a short period of time. Meanwhile, other information can be distributed using other techniques, such as a CD.

Identify factors affecting the design of an efficient ICT system for training brokers

From ordinal logistics regression, the following four factors are proven, statistically, to have a critical relationship with efficiency of an ICT system.

Financial: our findings corroborate those of Khan (2001) and Sribhadung (2006). i.e., that on-time payment of the system's expenses, such as buying and maintaining equipment, plays an important and critical role in the efficiency of the system. Olugbenga, Rotimi, & Olakulehin (2006) state that online learning has been found to be costly during the initial stage, gradually becoming cheaper due to economic scale effects. Thus AIF managers must be informed about the potential of online learning to be cost- effective in the long term.

Technical: the importance of technical factors pointed out by several authors, such as Barajas & Owen (2006), Surry (2002), Ebadi (2005), Castels (1996) among others, reflects that the AIF might pay more attention to appropriate hardware and software and infrastructure of the system, such as bandwidth.

Learner and Instructor: Our findings corroborate those of Sun et al (2007), Guglielmino (2002), Lynch (2001), Samak (2006), Tai (2005), among others, who found that positive attitude, knowledge, and skills of brokers and instructors had a direct impact on the efficiency of the system. Therefore, we suggest that the AIF to improve ICT knowledge and skills of both brokers

and instructors. Happily, we found that the brokers generally have positive attitudes about ICT-based training system (Omidi, 2008). So, we recommend that the AIF use instructors who have a similarly positive attitude about the efficiency of ICT and can help to increase the brokers' already positive attitude about ICT.

Identify challenges in an educational ICT system

As the ordinal factor analysis showed, one may categorize 36 challenges, listed in Section 3, into four factors, ordered by impacts as *technical*, *human*, *organizational*, and *social* challenges. These challenges are not necessarily inevitable, and with careful design, most can be overcome. Based on our findings, technical challenges are the most important confirming similar findings by Ho (2002) and sim & Fresht (2007). Technical problems are always potentially troublesome in the case of synchronous training (video conferencing and virtual meeting), because issues such as sound and video quality can be affected by network traffic. As such, the AIF should consider selecting methods which do not require high bandwidth, such as asynchronous methods.

According to the results, given in Table 11, one can suggest an ICT based training system which (1) use CD for materials which do not change so much during the time. (2) Have two options for bandwidth depend on speed of connection for synchronous method. (3) Design their web page with only text and simple graphs because of slow connection. (4) Use cell phone (mobile learning) for short and urgent messages.

CONCLUSION

The AIF spends considerable time, effort and money to train brokers. Unfortunately, many of their educational investments are met with disappointing results and traditional education is no longer effective. An ICT-based training system seems the best solution to this problem.

Table 5 clearly shows several pieces of good news about the target population. We are dealing with a young, educated population who are already spending considerable time (5hours/week on average) surfing the web, suggesting that an ICT-based system could be implemented and used successfully.

This study provides insights for AIF to see all the components (learner, instructor, technical, technical experts, organizational, cultural, evaluation, financial) in an ICT based training system as whole. Corporations, in their rush to implement e-learning often place too much emphasis on the "e" and too little on the learning part of e-learning. So the development of an ICT-based system should take into consideration all of the components discussed in this research. The results have shown that educational leaders in AIF must take a hard look at financial, technical, learner and instructor factors compared to the other factors. The challenges which will be faced in this system have been studied. The authors believe, overcoming the challenges discussed in this study require immediate and major solutions, which may be offered by AIF through their provision of financial incentives and loans to buy ICT equipment etc. Major change requires some legislation to improve structural facilities, as well as the country's infrastructure and copy right law, which will play a crucial role in the implementation of an ICT- based training system.

Although, this research represents a systematic effort to incorporate elements of an ICT-based training system, it has several limitations such as: 1) this was the first comprehensive study focused on designing an ICT-based training system; 2) it is lacking in companies with expert knowledge in both ICT-based and instructional science, which could be addressed if AIF employ experts in both ICT and instructional education. The authors suggest that the AIF should implement an ICT-based training system for the Tehran and Ilam provinces as a trial (pilot survey,

since these provinces would include most scenarios that could be experienced in agricultural training, including a variety of cultural, educational, and financial features.

There is little doubt as ICTs efficacy for training brokers; the challenge for the future will be to design and market ICTs for training directly for the policy holders.

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